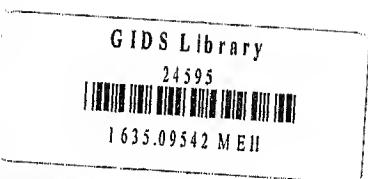


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Horticulture in the Development of Western Himalayan Agro-Climatic Region

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**HORTICULTURE IN
THE DEVELOPMENT OF WESTERN
HIMALAYAN AGRO-CLIMATIC REGION****

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Introduction

Despite the rapid strides made in agriculture production during the planning exercise of last forty years, inter-regional, inter-sectoral and inter-class disparities in the agricultural development are still existing. This is basically due to the lack of proper planning approach and the lack of required attention in the need of specific location and region of the country. Therefore, the Planning Commission felt it desirable to formulate a development strategy based on the profile of the region specific in terms of the availability pattern and use of various natural resources and the potentials and prospects of various regions.

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This planning strategy provided by delineating the country into fifteen broad agro-climatic zones based on the characteristics of soil, topography, climate, rainfall and water availability. The approach of the Agro-climatic Regional Planning lies in assessing regional potentials and problems and thus evolving development strategies and programmes suited to the local resource endowments and needs of the farmers. The approach also focus on the aspects related to the development programme of agriculture for area specific and follow regional development strategy. The major objective of the planning exercise for Agro-Climatic Zones is also to generate, within a regional framework, a plan for creating additional employment opportunities particularly for the benefits of land less labourers and marginal farmers.

In this planning exercise of the Agro-Climatic Zone, the two hilly states, Jammu and Kashmir and Himachal Pradesh and a hill region of Uttar Pradesh, are included in the Western Himalayan Region. In the identified himalayan zone, situated on the northern part of the country, the agricultural activity is a main source of livelihood of a majority of the population. And the pressure of population is unprecedently increasing on it. However, even after initiating several measures towards agricultural development under the planned development strategies during past the agricultural productivity has not been increasing satisfactorily due to the nature of terrain and steep

slopy small land holdings. The horticulture industry also occupies an important position in the farming system of the himalayan zone. The region has different climatic zones suitable for growing temperate, sub-tropical and tropical fruits. Temperate fruits like apple, pear, peach, plum, apricot, cherry, walnut, hazelnut etc. are grown at elevation of 1000 to 3000 metres above sea levels. In areas extending from 300 to 1400 metres sub-tropical fruits viz. citrus, mango, litchi, locat, guava, banana, papaya, strawberry etc. are grown successfully. However, the farmers in the region are mainly putting their available land area under the cultivation of field crops for several generations while the cultivation of agricultural crops in the region has proved to be un-economic.

The Study

In this light the present paper beside examining the potentials and feasibilities of horticulture development, examines the differences existing in the level of productivity, returns and employment absorption capacity between agriculture and the horticulture sector in Himachal Pradesh and the hill region of Uttar Pradesh of Himalayan Agro-Climatic Zone. Since the cultivation of apple is mainly carried out in the region therefore the main focus of the study is on the cultivation of apple. The paper is an outcome of the study carried out by the Giri Institute

of Development Studies in collaboration with Development Research Institute Tilburg, The Netherlands. For the study a sample of 501 fruits growers consisting of 251 growers in H.P. and 250 growers in U.P. hills was selected from the areas which are famous for growing fruits particularly apples. The sample of growers was selected proportionately from different orchard sizes.

Characteristics and Potentials of Horticultural Development
in the Sample Areas

The state Himachal Pradesh is situated in the North West Himalayan Region touching Uttar Pradesh in the East, Jammu and Kashmir in the north, Tibat and China in the North East and Punjab and Haryana in the south. The state has geographical area of about 56 thousand sqr. kms. It has twelve districts and a population of 42.81 lakhs living in 16807 villages and score of towns. The physiography of the state consists of mountaneous tract with elevations ranging from 350 metres to 6975 metres above sea level. The climate varies from hot to severe cold depending upon elevation. The state has the highest and lowest average rainfall varing from 18 cms to 300 cms and average rainfall accounts 150 cms. Agriculture is the mainstay of around 76 per cent of the rural population. The land under cultivation is 6.26 lakh hectares out of which 20 per cent is under horticulture. Average size of holdings is 1.62

hectares. The fruit industry is an important source of household incomes for majority of the agriculturally dominating population of the state. Among the important fruits grown in the state, apple is an important dominating commercial fruit which is grown in the area whose altitude is 1500 metres or more above sea level. In these areas soils are quite deep and fine lectured varying from silt loan to clay loan and are of light to dark brown colour with good reserve of humus and limited quality of minerals and plant food, the soil is thus very productive. The plantation of fruits particularly apple is going to be quite popular in H.P. as the area under apple plantation has been increasing tremendously. The total area under fruits which was 792 hectares during 1950-51 has increased to 1.35 lakh hectares during 1986-87. Of the total area under fruits during 1986-87, sizeably a highest proportion of area amongst all fruits is under the cultivation of apple (69.26 per cent) followed by citrus (22.22 per cent) and under temperate fruits (18.52 per cent). The productivity of apple is estimated to be around 6.8 tonnes per hectare in the state.

On the other, the U.P. hills comprising eight districts, situated on the northern part of the state Uttar Pradesh lies in the central Himalayas. The elevation of hills extends from approximately 300 metres to 7000 metres above sea level and the temperature ranges from 16°C to 40°C , but normally it goes upto freezing point even -5°C .

during winter. The geographical area of the entire hills is 51.25 thousand sqr. kms. Out of which 841.97 thousand hectares is under cultivation. And the fruits are grown over 148 thousand hectares. There has been an increase of 23.21 per cent and 55.65 per cent in the production and the area of fruits between 1980-81 to 1986-87 in the region. The main fruits grown in this area are apple, apricot, plum, peach etc. while apple is the main fruit crop which is cultivated in an area of 49 thousand hectares. The population of the region as per 1991 census is 5.87 million which is 4.23 per cent population of the state. As per 1981 census, the main occupation of the 70.6 per cent workers in the region is agriculture and 92 per cent of the population is depending on agriculture for their livelihood. However the cultivated land in the region constitutes only 12.52 per cent and a large part of it is under forest (63.77) per cent. The land holdings are also very small. Average size of land holdings and the percentage of area under small and marginal holdings constitute to be 0.99 hectares and 84 per cent respectively. And 60 per cent of the operational land holdings in the region are less than one hectares and 94 per cent holdings are less than three hectares. Besides, the nature of terrian, scattered marginal and steep slopy land holdings have not been providing well in increasing agriculture productivity.

The horticulture industry, therefore occupies an important position in the farming system and thus for providing gainful employment opportunities and increasing the income of the masses in the hilly region. Besides this, the development of tree plantation provide permanent green cover to the soil. Further cultivation of fruits have a special significance as compared to field crops since they provide a higher source of nutritive diet value to consumers and relatively higher value which boost the returns, provide better stability through multi-product range and offer a better opportunity for value adding than field crops to the farmers. Moreover, the cultivation of fruits is purely labour intensive and requires significantly higher labour force starting from the stages of tree plantation to the point of its marketing. Being a labour intensive enterprise it is well suited to an area like Himalayan Agro-Climatic Region, which have abundance of manpower and a relatively scarcity of capital resources. At the same time production of fruits can be helpful in earning foreign exchange through proper exports of fresh as well as processed fruits.

Basic Requirements for Plantation of Apples

As indicated earlier that among the various fruits cultivated in H.P. and hill region of Uttar Pradesh, the apple is a main fruit crop which is grown on a much larger proportion of the total fruit grown area. Our focus of

study is, therefore, devoted in the cultivation of apple in the sample states. The plantation of apple can be carried out in the temperate hilly areas with lower temperature. In winter apple trees require temperatures below 7°C (45°F). Most apple varieties need such temperatures for about 200 hours in order to achieve complete and adequate rest, though some varieties can manage with as little as 200 hrs. of chilling. During summer, apple trees require around 20° to 30°C ($58-86^{\circ}\text{F}$) temperature. Apple can be grown in a wide range of rainfall from evenly spread rains of 25 to 37 cm. (10-15") per year to heavy seasonal rains upto 125 to 175 cm (50-70") as during monsoon. Besides, certain minimum soil moisture is necessary for the proper growth of the apple trees and the development of fruits. Thus looking at the geographical conditions, availability of soil, climate and other basic favourable conditions need for the plantation and development of apple it seems that both H.P. as well as hill region of U.P. are most suitable for growing the apple in the available land area so as to create the additional employment opportunities and increase the income levels of the population.

However, the development of apple cultivation has been at much higher order in Himachal Pradesh as compared in U.P. hills because the cultivation of apple in former state has started much earlier than in the later one. The productivity of apple per hectare is estimated around 3.4 tonnes in U.P. hills which is around half of the

productivity rate of apple in H.P. However if we consider the increase in area and production of apple in H.P. and U.P. hills between 1970-71 and 1985-86, the area under apple plantation and production of apple has increased at much higher rate in U.P. hills as compared to H.P. The area under apple has increased 72.26 per cent in H.P. and 148.26 per cent in U.P. hills and also the production of apples has increased by 130.26 per cent in H.P. and more than three folds in U.P. during 1985-86 over the period 1970-71.

Productivity Levels of Apple

Productivity of apple trees is to be examined across their different age groups of the plantation. The differentials in productivity at similar age groups of trees are expected to be determined by the differentials in geographical and climatic conditions of the areas, varieties of apple trees grown, utilisation pattern of various infrastructural facilities for the growth and development of the apple trees. However the quantum of production per tree is expected to increase simultaneously with the growth and the development of trees although it starts decreasing after reaching at a certain age of trees. Our analysis reveals that the average production per tree works out to be around 61 kgs. and the peak production per tree touched around 86 kgs between the age group of 31 to 50 years. It has also been noticed that the production per

tree is systematically increasing according to the increase of age of the apple trees however, after reaching at peak productive stage of the trees the productively is found to be decreasing to a certain extent. The state level analysis reveals that the productivity of apple trees at their different age groups is around three folds higher in H.P. and compared to U.P., however the apple trees that are starting bearing fruits at their earlier ages of 5 years are found in case of U.P. only. The average production per tree is estimated to be 87 kg. for H.P. as against of 23 kg for U.P. The highest differentials in productivity rates of apple trees are in favour of H.P. and are due to the facts that in H.P. varieties of apple trees planted are higher productive and the commercialisation of apple begun quite earlier in H.P. than in U.P. which have influenced the grower to use the scientific methods of cultivation of apple trees, proper and sufficient use of various inputs like chemicals, fertilizers and pesticides in case of former than the later state.

Table 1 : Productivity of Apple Trees by their Age Groups.
(in Kg.)

Age Group of Trees (years)	Himachal Pradesh		Uttar Pradesh		All States	
	Produ- ction	Produ- ction per tree	Produ- ction	Produ- ction per tree	Produ- ction	Produ- ction per tree
Upto - 5	--	--	6000	0.41	6000	0.31
6 - 10	14570	8.77	10400	1.30	24970	2.59
11 - 20	1478124	92.05	1193480	34.11	2671604	52.54
21 - 30	2701194	97.61	490953	31.41	3192147	73.72
31 - 50	1214583	96.43	74548	31.61	1289131	86.21
above 50	77775	94.27	6000	29.27	83775	81.33
All Age Groups	5186246	86.84	1781381	23.45	7267627	52.24

Level of Productivity Costs and Returns

Estimating the per unit value of production, costs and returns the analysis shows that the cultivation of apple is comparatively much more profitable than the cultivation of field crops. The apple crop is found providing 53 per cent higher amount of returns than the field crops and the productivity per acre of land is also found to be over five times higher in the case of the cultivation of apple than the agricultural crops. However, the returns per acre of land in the cultivation of apple are found significantly much higher in the case of Uttar Pradesh. And the returns in the cultivation of apple as compared to the agricultural crops are found to be 53.20 per cent for U.P. as against nine times higher for H.P. It has also been observed that the higher amount of returns in case of apple cultivation are the result of higher amount of per unit investment carried out by farmers on its cultivation than on the agricultural crops. As the per acre cost of production in apple growing is turned out to be three folds and over ten folds higher than the cost of cultivation of agricultural crops in U.P. and H.P. respectively. Further we observed that the benefit of growing apple is of a higher order for the farmers with smaller size of orchards than with relatively larger size of orchards.

Table - 2(a) : Per Acre Value of Production, Costs and Returns (Himachal Pradesh and Uttar Pradesh Combined.)

Size of Orchard No. of trees	Production		Costs		Returns	
	Agri-culture	Apple	Agri-culture	Apple	Agri-culture	Apple
Below 75	3175	17475 (450.39)	2905	13767 (373.91)	270	3708 (1273.33)
75-100	2703	29586 (994.56)	1341	10837 (708.13)	1362	18749 (1276.58)
100-150	4096	18448 (350.39)	2251	7758 (244.65)	1837	10690 (481.93)
150-200	4784	30851 (554.88)	1779	12297 (591.23)	3005	18554 (517.44)
200-300	5116	33064 (546.29)	2145	12604 (487.60)	2971	20460 (588.66)
300-400	5053	29776 (489.27)	705	18369 (2505.53)	4348	11407 (162.35)
400-600	6553	29406 (384.74)	1217	12252 (906.73)	5336	17154 (221.48)
600 and above	4964	26060 (424.98)	834	9280 (1004.08)	4130	16780 (306.30)
All Groups	4664	28036 (501.12)	1641	12071 (635.59)	3026	15965 (427.59)

Note: Figures in brackets indicate the differences in Productivity, Costs and returns between the cultivation of agricultural crops and apple.

Table - 2(b) Per Acre Value of Production, Costs and Returns from Agricultural Crops and Apples in Himachal Pradesh.

Size of Orchard No. of trees	Production		Costs		Returns	
	Agri-culture	Apple	Agri-culture	Apple	Agri-culture	Apple
Below 75	7120	50743 (612.68)	2656	45954 (1630.20)	4464	6289 (40.88)
75-100	3128	40120 (1182.60)	2142	14168 (561.43)	986	20052 (1933.67)
100-150	2826	35113 (1142.50)	2451	13816 (463.69)	375	21297 (5579.20)
150-200	3825	43014 (1024.32)	2384	15682 (557.80)	1442	26273 (1796.74)
200-300	3018	41628 (1279.32)	1876	15355 (718.50)	1142	26273 (2200.61)
300-400	2937	39267 (1236.98)	269	24951 (9175.47)	2668	14316 (436.58)
400-600	3818	40593 (963.20)	2547	13662 (436.40)	3271	26931 (723.33)
600 and above	6356	45594 (617.34)	1498	15769 (952.67)	4858	29825 (513.94)
All Groups	3937	41596	1505	17091	2432	34505

Note : Figures in brackets indicate the percentage differences in the productivity and returns between the cultivation of agricultural crops and apple.

Table - 2(c) : Per Acre Value of Production, Costs and Returns from Agricultural Crops and Apple in Uttar Pradesh.

Size of Orchard No. of trees	Prduction		Costs		Returns	
	Agri-culture	Apple	Agri-culture	Apple	Agri-culture	Apple
Below 75	2263	6126 (170.70)	2963	2786 (-6.35)	-700	3340
75-100	2516	7664 (204.61)	988	3904 (295.14)	1528	3760 (146.07)
100-150	4453	6205 (39.34)	2205	3307 (49.98)	2248	2898 (28.91)
150-200	5104	11368 (122.73)	1577	6876 (336.02)	3527	4492 (27.36)
200-300	6039	13561 (124.56)	2264	6338 (179.95)	3775	7223 (91.34)
300-400	5942	12998 (118.75)	888	6809 (666.78)	5054	6189 (22.45)
400-600	9214	13090 (42.07)	2868	6195 (116.00)	6346	6895 (8.65)
600 and above	4522	10253 (124.44)	623	4028 (546.55)	3899	6225 (59.66)
All Groups	4961	10644 (114.55)	1696	5642 (232.66)	3265	5002

Note : Figures in brackets indicate the percentage differences in production, costs and return between the cultivation of Apples and Agricultural Crops.

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Table - 3 : Per Acre Mandays Employment in the Cultivation of Agricultural Crops ar'l Apple in H.P. and U.P. Hills.

Size of Orchard No. of trees	Prduction		Costs		Returns	
	Agri-culture	Apple	Agri-culture	Apple	Agri-culture	Apple
Below 75	568	1516 (166.90)	358	446 (24.58)	397	718 (80.85)
75-100	363	643 (77.13)	137	436 (218.24)	207	575 (177.77)
100-150	286	509 (77.97)	204	340 (66.66)	222	412 (85.58)
150-200	274	473 (72.62)	140	500 (257.14)	173	484 (64.25)
200-300	212	380 (79.24)	241	362 (33.42)	232	373 (60.77)
300-400	68	371 (445.58)	64	325 (407.81)	65	354 (444.61)
400-600	51	260 (409.80)	206	262 (27.18)	129	262 (103.10)
600 and above	177	218 (23.16)	48	178 (270.83)	79	195 (146.83)
All Groups	207	386 (86.47)	174	307 (76.43)	184	351 (90.76)

Note : Figures in brackets indicate the percentage differences between employment in the cultivation of agricultural crops and apple.

Thus on the basis of these observations it will be proper to conclude that for providing more employment opportunities and increasing the levels of incomes of small farmers in the Himalayan Agro-Climatic Region the plantation of apple trees on their farms would be an appropriate policy measure.

Level of Employment Absorption

The manpower requirement in the cultivation and marketing of apple as well as field crops is met by employing paid workers as well as own family members. But carrying out the production and marketing of apple require significantly higher number of mandays employment as compared to agricultural crops. Our analysis reveals that on an average per acre land mandays requirement for carrying out production and marketing are reported to be 351; of which 66.67 per cent of the mandays are met by employing unpaid workers followed by 26.78 per cent by paid casual workers and 6.55 per cent paid regular workers. Further it is observed that the cultivation of apple is employing around 91 per cent higher mandays employment, consisting of 86 per cent in H.P. and 76 per cent in U.P., as compared to the cultivation of agricultural crops in the farms.

Further the growth in mandays employment in the production and marketing of apple has been calculated

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between the period of 1981 and 1986. The overall increase in mandays employment is registered to be around 40 per cent consisting 43 per cent in H.P. and 35 per cent in U.P. The highest increase in mandays employment is found in case of paid regular workers (100 per cent), followed by casual (67 per cent) and unpaid family workers (28 per cent). The highest increase in mandays employment for paid workers is registered in the orchard size group of 401 to 400 trees and lowest in the highest size group (63 per cent). Further in both the states the percentage increase in mandays employment for paid workers is also found significantly higher than the unpaid family workers. Thus growing apple is seen as an important activity which is providing employment opportunities, not only to the family workers of the growers but also to a sizeable proportion of the outside family workers as well. It has also been noticed that the supply of the workers from the growers families have been utilised at a optimal level and further requirements of workers is fulfilled by hiring paid workers. This is evident from the fact that there has been a much higher increase in the mandays employment of paid workers as compared to unpaid workers between the years 1981 and 1986.

Conclusion

Since the agriculture activity in the himalayan agro-climatic region has been well recognised to be un-economic. This is on account of undulating topography rugged terrain, steep slopy small holdings and several other unfavourable geographical conditions. Thus the typical topography agro-climatic conditions in the region limit the scope for production of field crops, but offer much suitable conditions for horticulture crops. The region has different climatic zones suitable for growing temperate, sub-tropical and tropical fruits, particularly for growing apple trees. Our analysis has well depicted that available land in himalayan agro-climatic region has experienced to be economically more suitable for the cultivation of horticulture crops particularly apple crop as compared to agricultural crops. As the level of per acre productivity as well as returns to the cultivation from the plantation of apples are significantly much higher than from the cultivation of agricultural crops. Also the cultivation of apple on per acre of land is providing comparatively larger/volume of employment opportunities to the local people than the cultivation of agricultural crops. Significant level of increase in the labour absorption in the cultivation of apples over the years has also been witnessed the importance of horticulture development for area development. Therefore, fruit plantation taken up on

a systematic and organised manner could be used as an effective instrument for providing the opportunity of gainful employment and to raise the income levels of the people. This programme could, therefore, prove useful in the himalayan agro-climatic region to mitigate the problem of existing poverty of the rural masses.

The marketing of horticulture crops in the region has been observed a major problems which is restricting the growers to convert their available land area from the cultivation of agricultural crops to horticulture crops. The growers, particularly small growers, are generally selling their produce on a pre-harvest contract basis so as to minimise risks. As a result, they are receiving much lower prices than the prices fetched while selling it directly in the market. The Government could, therefore, take up some steps in order to mitigate this disadvantage so that the farmers which are not cultivating horticulture crops may also be influenced to convert a sizeable land area from the cultivation of agricultural crops to the horticulture crops.
